

Sintering study of ferrites, BaTiO₃ and their ceramic composites

Mayara dos Santos Amarante¹, Rosana Silva Xavier², Manuel Henrique Lente³,
Luis Antonio Genova⁴, Vera Lúcia Othéro de Brito⁵

¹Instituto Tecnológico de Aeronáutica, ²Universidade Federal de São Paulo,
³Universidade Federal de São Paulo - Campus São José dos Campos, ⁴Instituto de
Pesquisas Energéticas e Nucleares, ⁵Instituto de Estudos Avançados

e-mail: mayara.s.amarante@gmail.com

Traditional solid-state sintering studies of cobalt ferrite are extremely rare in the literature [1]. Differences in thermal coefficients and ultimately lead to delamination, micro-cracking or pore formation in the ceramic materials. Phase changes as a result of sintering (e.g. tetragonal to cubic in BaTiO₃) can also contribute to sintering mismatch [2]. Cobalt ferrite and nickel cobalt ferrite powders were prepared using solid-state ceramic processing. Calcination of the ferrite powders was carried out with a heating rate of 5°C/min up to 1050°C and 240 min hold at 1050°C. The calcined powders were uniaxially pressed in the shape of Rectangular bars (20mm X 5mm X 4mm) and cold iso-statically pressed for use as samples for dilatometric thermal analysis. The dilatometry tests of the ferrites, the BaTiO₃ (TB), and ferrite-TB samples were carried out, some samples with constant heating rate and some samples simulating sintering with 2h hold time at a certain temperature. Based on the dilatometry results, sintering thermal cycles for both ferrites and TB were proposed. The microstructure of the sintered samples was evaluated by scanning electron microscopy and their densities were measured by the Archimedes' method. The results were discussed relating the density and grain size of the samples to the sintering parameters. The same was done with nickel cobalt ferrite and TB to obtain the composite. The sintering study were did to devise a maximum theoretical density of >90%.

Acknowledgments:

This work received financial support from CAPES (Pró-Estratégia 2011, project no. 26) and CNPq (proc. no. 461334/2014-3). The authors acknowledge the technical support received from INPE and Instituto de Aeronáutica e Espaço. For José Márcio Machado da Inês (in memorian).

References:

- [1] A. Rafferty, T. Prescott. *Cers. Int.* 34 15-21 (2008).
- [2] A. Rafferty, Y. Gun'ko. *J. Eur. Ceram. Soc.* 24 2005-2013 (2004).